Claims

1.The method of wave diagnostics of the oil-and-gas deposit which includes the excitation of the seismic waves by the near-surface sources of oscillations, the recording of the displacement vectors for the direct longitudinal and shear waves for the each observation point by means of the three-component seismic profiling along the depth of the investigated borehole and the processing of their kinematic and dynamical parameters, characterised that one near-surface source of oscillations executes in the vicinity of the borehole the longitudinal wave excitation, and their reception is carried out simultaneously in the investigated and check boreholes; after the space orientation of the three-component observation data, the monotype temporal signals for the compression and shear components of the direct longitudinal wave are extracted from the seismic signals which were registered on the axial and tangential components of the displacement vector for the downhole and check devices respectively; further by means of processing of the kinematic parameters for the direct longitudinal and shear waves interval values of the elastic moduli (longitudinal and shear) are calculated; after the decoding of the monotype temporal signals quantitative estimates of their significant dynamical parameters are made for each component and the observation point according to the downhole and check data, moreover the accuracy of the obtained estimates of the dynamical parameters is monitored by means of the computer modelling of the seismic signals; then, carrying out the correction of the corresponding parameter because of the changes of the wave excitation conditions and the filtration of the seismic signals in the covering thickness of the rocks, defines the dynamical parameters of the impulse responses, values of the coefficients of dynamical viscosity (volumetric and shear) and absorption (for compression and shear components) of the layers, when the calibrated values of the absorption coefficients for the compression component are used as the indicators of the hydrocarbon presence and the fluid type in the layers, and also values of the bedded coefficients of the amplitude attenuation and energy dispersion of the longitudinal wave are calculated; then, using the functional relationships, which are taking into account the thermodynamical conditions of rock bedding, the obtained petrophysical data are converted into the values of the parameters of the reservoir and fluid-saturated properties of the layers with the aim of the receipt of the necessary totality of the significant oil-field parameters for the identification of the image of the oil-and-gas deposit.

2. According to cl. 1.the method is characterised as including three stages:

- the three-component observations and the recording of the seismic waves in the investigated and check boreholes;

- the data processing of the downhole and check observations, that are brought to them in the shape of the data, representing the values of the dynamical parameters of the impulse responses and the petrophysical parameters of the layers of the rocks;
- the transformation of the petrophysical data for the layers of the rocks into the values of the oil-field parameters - attributes for the identification of the image of the oil-and-gas deposit.

3. According to cl. 1. the method is characterised that the depth of the location of the explosive charge (or air gun) for the excitation of oscillations in the near-surface borehole is defined out of the condition of the separation of the direct longitudinal wave from the satellite waves, which are shaped in the time of the reflection from the free surface.

4. According to cl. 2. the method is characterised that the recording of the displacement vectors for the direct longitudinal (or shear) wave is carried out simultaneously in the investigated and check boreholes, moreover in the investigated borehole - with the help of the three-component multimodular downhole sonde moving along the depth of the borehole, and in the check borehole - the stationary located three-component one-modular sonde.

5. According to cl. 3. the method is characterised that the detailed three-component profiling in the investigated borehole is executed with the step of the discrete observations every 2.5 - 5 m.

6. According to cl. 1. the method is characterised that the check borehole is located on the trajectory of the propagation of the direct longitudinal (or shear) wave and on the line connecting the investigated borehole and the shotpoint at the distance of 20 - 50 m from the last.

7. According to cl. 1. the method is characterised that the data processing of downhole and check observations is carried out by means of the extraction of the monotype temporal signals for the compression and shear components out of the observation data on the axial (or longitudinal) and the tangential (or shear) components of the displacement vector for the direct longitudinal wave, previously oriented in the space.

8. According to cl. 1. the method is characterised that in quality of the significant dynamical parameters of the monotype temporal signals for the compression and shear components of the direct longitudinal wave makes use of the initial amplitudes, the exponents of steepness, the temporal coefficients of attenuation, the instantaneous frequency and the initial phases.

9. According to cl. 7. the method is characterised that the processing of the seismic signals of the direct longitudinal wave for the downhole observations includes the following basic stages:

- the monotype temporal signals for the compression and shear components are decoded and the quantitative estimates of their significant dynamical parameters are obtained for each observation point as the function of the depth of the borehole;

- the interval values of the elastic moduli (longitudinal and shear) with the further calculation of the coefficients of the dynamical viscosity (volumetric and shear) are defined as well as the absorption coefficients and the quality factors (Q-factors) for the compression and shear components;
- the use of the calibrated values of the absorption coefficients for the compression component of the direct longitudinal wave in quality the indicator of the hydrocarbon presence and the fluid type (oil, gas or water), filling the pore and fissured space in the rocks;
- the bedded coefficients of the effective attenuation, attenuations owing to the thin-laminated medium and dispersion on the local intrastratal inhomogeneities are calculated by means of the spatially-group processing of the estimate values of the amplitude parameters that have been corrected previously owing to the change of the conditions of the wave excitation and the geometrical divergence of the wavefronts;
- the petrophysical data are converted according to the functional relationships into the values of the parameters of the reservoir and fluid-saturated properties of the layers of the rock and the necessary totality of the significant oil-field parameters for the identification of the image of the oil-and-gas deposit is received.